

East Penn School District
Curriculum and Instruction

Curriculum for: Botany-Zoology, College Preparatory

Course(s): CP Botany-Zoology

Grades: 10-12

Department: Science

Length of Period (average minutes): 42

Periods per cycle: 6

Length of Course (yrs): 1

Type of offering: elective

Credit(s) awarded: 1.0 4.0/4.0

Developed by: Corinna Kramer-Hinks and Brent Landrum

ADOPTED: 2018

Enduring Understandings	Essential Questions	Knowledge	Skills	Standards
<ul style="list-style-type: none"> ● The origin of life and evolution of cells billions of years ago can be inferred through use of the fossil record. ● The evolution of cellular complexity has lead to the diversity of life today: <ul style="list-style-type: none"> - unicellular to multicellular organisms - influence of metabolic pathways - endosymbiosis resulting in eukaryotes from prokaryotes. 	<ul style="list-style-type: none"> ● What does the origin of life on Earth reveal about our ancestors from the past? ● What is the importance of metabolic pathways to the evolution of cells? ● How has the evolution of cells lead to modern day biodiversity? 	<ul style="list-style-type: none"> ● Life on Earth theoretically evolved 3.9 billion years ago, although the first true fossils of life are dated to 3.5 billion years ago. ● Cells evolved due to changing conditions on Earth. ● Modern day classification schemes are based on the evolution of simple cells to complex cells including unicellularity leading to multicellularity, prokaryotes leading to eukaryotes, and chemotrophs, autotrophs leading to heterotrophs. ● Energy can be obtained by cells in various metabolic pathways depending on the type of cell. ● Molecular, structural, and reproductive lines all provide evidence to support the theory 	<ul style="list-style-type: none"> ● Analyze the major cellular developments in the origin of cells for the first 3.5 billion years of Earth's history. ● Compare/contrast the metabolic pathways including chemosynthesis, photosynthesis, anaerobic respiration, and/or aerobic respiration. ● Explore the origins of eukaryotic life by investigating the evidences of the theory of endosymbiosis. ● Using phylogenetics, infer how the evolution of cellular complexity resulted in the 3 taxonomic domains and 6 taxonomic kingdoms on the modern day tree of life. 	<p>NGSS Standards:</p> <ul style="list-style-type: none"> ● HS-LS4-1 Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. ● HS-LS4-2 Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment. ● HS-LS4-4 Construct an explanation based on evidence for how natural selection leads to adaptation of populations. ● HS-LS4-5 Evaluate the evidence supporting claims

		of the evolution of eukaryotic life through endosymbiosis.	<ul style="list-style-type: none"> ● Demonstrate that evolutionary theory operates today as it did in the past and as it will continue to do so in the future. 	that changes in environmental conditions may result in:(1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.
<ul style="list-style-type: none"> ● Photosynthesis allowed for the evolution of terrestrial life during the Paleozoic era. ● Terrestrial plants needed to adapt to the lack of a continuous supply of water. ● Terrestrial plants developed various successful adaptations in order to overcome obstacles to life on land. ● Coevolution between plants and animals was an essential part of terrestrial evolution. 	<ul style="list-style-type: none"> ● What factors allowed terrestrial life to evolve? ● What adaptations developed in plants that allowed them to overcome obstacles to terrestrial life? ● How was co-evolution an important concept to the evolution of terrestrial life? 	<ul style="list-style-type: none"> ● Photosynthetic bacteria increased atmospheric oxygen and ozone establishing the initial conditions required for life to evolve on land. ● Terrestrial plants required anatomical and physiological adaptations for reproduction, to prevent desiccation and to absorb minerals from the soil. In plants these adaptations include: <ul style="list-style-type: none"> - guard cells to control stomata - cuticle - vascular tissue - roots with mycorrhizae - deciduous leaves or needles as leaves 	<ul style="list-style-type: none"> ● Explain how changes in environmental conditions on Earth allowed for the evolution of terrestrial life. ● Summarize the obstacles that terrestrial plants overcame when adapting to life on land. ● Investigate and describe the anatomical and physiological adaptations that terrestrial plants developed as a result of natural selection. ● Analyze how alternation of generations is beneficial for the 	<p>NGSS Standards:</p> <ul style="list-style-type: none"> ● HS-LS4-1 Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. ● HS-LS4-2 Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.

		<ul style="list-style-type: none"> - alternation of generations ● As plants adapted to life on land, they developed co-evolutionary relationships with other organisms. 	<ul style="list-style-type: none"> ● evolution of terrestrial plants. ● Explain how co-evolution enabled the development life on land as we know it. ● Demonstrate that evolutionary theory operates today as it did in the past and as it will continue to do so in the future. 	<ul style="list-style-type: none"> ● HS-LS4-4 Construct an explanation based on evidence for how natural selection leads to adaptation of populations. ● HS-LS4-5 Evaluate the evidence supporting claims that changes in environmental conditions may result in:(1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.
<ul style="list-style-type: none"> ● What is a theory? ● What is the theory of evolution? ● What influences lead Darwin to propose the concept of descent with modification? ● How do the mechanisms of evolution affect microevolution and macroevolution? ● What evidences support the theory of evolution? ● What causes the genetic variation upon which selection acts? 	<ul style="list-style-type: none"> ● Theories explain natural phenomena using testable predictions. ● The principles of the theory of evolution explain the diversity of life. ● The development of Darwin's ideas were influenced by multiple sources. ● Multiple lines of evidence can be used to support the theory of evolution. 	<ul style="list-style-type: none"> ● The principles of Darwin's theory of evolution include the concepts of overpopulation, genetic variation, inheritance of traits, and acquired adaptations through competition/struggle for existence leading to evolution by means of natural selection (AKA descent with modification). ● The mechanisms of evolution of a population include mutation, migration, 	<ul style="list-style-type: none"> ● Apply Darwin's principles for his theory of evolution to explain how species change over time. ● Explain how overpopulation and genetic variation create the conditions for evolution. ● Illustrate their understanding of evolutionary mechanisms with real-life examples. ● Communicate how the lines of evidence support 	<p>NGSS Standards:</p> <ul style="list-style-type: none"> ● HS-LS4-1 Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. ● HS-LS4-2 Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3)

	<ul style="list-style-type: none"> • Genetic variation comes from several sources. • Microevolution and macroevolution which act in different ways both rely on the same mechanisms. 	<p>genetic drift, and natural selection.</p> <ul style="list-style-type: none"> • Evidences for evolution include molecular (DNA, amino acid, proteins, mtDNA, master control genes), geological (including the fossil record, transitional forms, and plate tectonics), anatomical (including homologous, analogous, and vestigial structures) and embryological lines in addition to transitional species in the fossil record, and speciation events. • Malthus, Lyell, Wallace, Lamarck, geological processes, religious beliefs of the time, and Darwin's travels among other things influenced the development of his ideas on evolution. • Selective pressures for heritable traits will lead to the evolution of species 	<p>the theory of evolution.</p> <ul style="list-style-type: none"> • Communicate the influences that lead to the development of Darwin's theory of evolution. • Predict how selective pressures can change the frequencies in a population for a specific trait and infer how future populations will be affected by changes in allele frequencies. • Demonstrate that evolutionary theory operates today as it did in the past and as it will continue to do so in the future. 	<p>competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.</p> <ul style="list-style-type: none"> • HS-LS4-4 Construct an explanation based on evidence for how natural selection leads to adaptation of populations. • HS-LS4-5 Evaluate the evidence supporting claims that changes in environmental conditions may result in:(1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species. • HS-LS3-2 Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors. • LS3.B Environmental factors also affect
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		<p>over time (including disruptive, directional, stabilizing selection) with varied results dependent upon the gene(s) controlling the trait (single gene, polygenic, transposons, master control genes).</p>		<p>expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed depends on both genetic and environmental factors. (HS-LS3-2),(HS-LS3-3)</p>
<ul style="list-style-type: none"> • All vertebrates share common characteristics due to common ancestry. • Vertebrate classes developed various successful adaptations in response to changing conditions on the Earth. • There have been many transitional groups of vertebrates many of which are now extinct. 	<ul style="list-style-type: none"> • What are the defining characteristics of the vertebrate subphylum and 7 vertebrate classes? • What are the most successful adaptations of the 7 vertebrate classes throughout Earth's geological timeline? • What does fossil evidence reveal about the transitional forms between vertebrate classes? 	<ul style="list-style-type: none"> • Since all vertebrate classes are in the same taxonomic phylum with a common ancestor, they share common characteristics. • The 7 vertebrate classes developed different adaptations of circulatory, respiratory, excretory, reproductive and nervous systems. • Fossils of transitional forms (placoderms, lobe finned fish, tetrapods, thecodonts, pelycosaurs, therapsids, dinosaurs, and dino-birds) provide 	<ul style="list-style-type: none"> • Compare vertebrate classes to determine common characteristics they share. • Contrast several vertebrate classes based upon adaptive differences between them. • Demonstrate understanding of circulatory, respiratory, excretory, reproductive and nervous system adaptations and the reasons why they developed. • Analyze and interpret several transitional 	<p>NGSS Standards:</p> <ul style="list-style-type: none"> • HS-LS4-1 Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. • HS-LS4-2 Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and

		<p>evidence of evolution as a slow process by which speciation occurs.</p> <ul style="list-style-type: none"> Fossil, physical and molecular evidences reveal relationships between vertebrates. 	<p>vertebrate forms based upon the fossil record and where they fit into the taxonomic scheme of vertebrates.</p> <ul style="list-style-type: none"> Demonstrate that evolutionary theory operates today as it did in the past and as it will continue to do so in the future. 	<p>reproduce in the environment.</p> <ul style="list-style-type: none"> HS-LS4-4 Construct an explanation based on evidence for how natural selection leads to adaptation of populations. HS-LS4-5 Evaluate the evidence supporting claims that changes in environmental conditions may result in:(1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.
<ul style="list-style-type: none"> Adaptations are used to distinguish arthropods including insects from one another. Multiple lines of evidences suggest common ancestry in insects. The knowledge of insects can be applied to solve everyday problems. 	<ul style="list-style-type: none"> What characteristics define the major groups of insects? What are evidences of common ancestry in insects? What adaptations allow for the terrestrial life of insects? How is the knowledge of insects applicable to everyday life? 	<ul style="list-style-type: none"> Insects are classified into taxonomic groups based upon: <ul style="list-style-type: none"> wings leg parts how body segments are attached Insect adaptations allow for terrestrial life and as well as suggest common ancestry: <ul style="list-style-type: none"> jointed appendages exoskeletons circulation segmentation body cavity 	<ul style="list-style-type: none"> Categorize arthropods (including insects) into groups. Investigate the adaptive features of insects that indicate common ancestry and compare/contrast adaptations. Explore the local importance of several native insects. Investigate the importance of metamorphosis 	<p>NGSS Standards:</p> <ul style="list-style-type: none"> HS-LS4-1 Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. HS-LS4-2 Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due

		<ul style="list-style-type: none"> - homologous structures - vestigial structures ● Insect orders, their unique anatomical and physiological adaptations to terrestrial life, and how that knowledge relates to everyday life. - Homoptera - Hemiptera - Orthoptera - Anopleura - Siphonaptera - Coleoptera - Lepidoptera - Dermaptera - Odonata - Hymenoptera - Thysanura - Neuroptera - Diptera ● Understand the importance of metamorphosis as it relates to each EQ. 	<p>with regard to insect adaptation, common ancestry, and application to everyday life.</p> <ul style="list-style-type: none"> ● Demonstrate that evolutionary theory operates today as it did in the past and as it will continue to do so in the future. 	<p>to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.</p> <ul style="list-style-type: none"> ● HS-LS4-4 Construct an explanation based on evidence for how natural selection leads to adaptation of populations. ● HS-LS4-5 Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.
<ul style="list-style-type: none"> ● Adaptations are used to classify plants. ● Plant diversity reflects the evolutionary history of the plant kingdom. ● Angiosperms are classified based upon 	<ul style="list-style-type: none"> ● What are distinguishing characteristics of nonvascular and vascular plants? ● What are the characteristics and/or 	<ul style="list-style-type: none"> ● Nonvascular and vascular plants are differentiated according to how materials are transported within them which provides 	<ul style="list-style-type: none"> ● Differentiate between nonvascular and vascular plants. ● Explain the evolutionary relationships among plant 	<p>NGSS Standards:</p> <ul style="list-style-type: none"> ● HS-LS4-1 Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

<p>their leaves, stems, and flowers due to common ancestry.</p> <ul style="list-style-type: none"> • Alternation of generations allows plants to reproduce both sexually and asexually. • Sexual reproduction in angiosperms results in the formation of fruits and seeds from flowers. • Some angiosperms and insects exhibit co-evolution. 	<p>adaptations used to classify plants?</p> <ul style="list-style-type: none"> • How is alternation of generations beneficial to plants? • How are angiosperms unique? • How does the symbiosis between some angiosperms and insects affect their co-evolution? 	<p>the basis for plant classification.</p> <ul style="list-style-type: none"> • Plants share a common ancestor 440 mya during the Paleozoic era but have diverged from one another for the past 320 mya resulting in much biodiversity. • Plants are classified in 12 divisions based upon structural characteristics or adaptations such as type of transport as well as other tissues present, and type of reproduction. (bryophyte plants includes 3 divisions of nonvascular plants whereas tracheophyte plants have 4 divisions of vascular seedless plants and 5 divisions of vascular seed forming plants.) • Angiosperms are a type of vascular seed forming plant subdivided into 2 classes (monocots and dicots) based 	<p>divisions and discuss when they evolved or diverged from one another.</p> <ul style="list-style-type: none"> • Differentiate between the major structural characteristics or adaptations of each plant division and describe how they function. • Investigate the differences between monocots and dicots. • Assess whether a plant is monocot or dicot by examining structures present. • Investigate the main parts of all angiosperm leaves, stems, and flowers. • Distinguish between monocot vs dicot leaves, stems, and flowers. • Identify the 4 whorls of a typical flower and the floral parts that make them up. • Summarize the steps of an 	<ul style="list-style-type: none"> • HS-LS4-2 Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment. • HS-LS4-4 Construct an explanation based on evidence for how natural selection leads to adaptation of populations. • HS-LS4-5 Evaluate the evidence supporting claims that changes in environmental conditions may result in:(1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.
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		<p>upon number of flower and seed parts and stem and leaf structure.</p> <ul style="list-style-type: none"> • Due to common ancestry, all angiosperms have the same basic flower(floral), stem, and leaf parts but can be arranged differently. • The sexual organs of an angiosperm are the flowers which are composed of 4 floral whorls, or series (calyx, corolla, androecium, gynoecium), plus the floral parts that make up the whorls. • Angiosperms alternate between reproducing sexually using gametes from the fertile floral whorls and reproducing asexually using either spores from spore cases or from vegetative propagation. • In order to reproduce sexually, sperm containing 	<p>angiosperm's life cycle with alternation of generations.</p> <ul style="list-style-type: none"> • Chronologically arrange the steps of sexual reproduction in flowers from pollination to seed germination. • Assess whether certain angiosperms are complete, incomplete, perfect, imperfect, pistillate, staminate, composite, monoecious, or dioecious based upon the floral whorls. • Investigate examples of mutualism involving angiosperms and insects and how they have co-evolved as a result. 	
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		<p>pollen from a flower needs to be transferred to an egg in another part of a flower through pollination and double fertilization occurs, followed by fruit and seed formation, seed dispersal, and finally seed germination.</p> <ul style="list-style-type: none">• Flowers come in many forms based upon whorls present including complete vs incomplete, perfect vs imperfect, pistillate vs staminate, and composite.• Angiosperm plants come in two forms based upon presence and location of male vs female flowers (monecious and dioecious).• Mutualism is a type of symbiosis between some angiosperms and insects in which both benefit, so as one evolves the other must as well,		
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		resulting in their co-evolution.		
<ul style="list-style-type: none"> • Types of reproduction can be distinguished by number of parents and amount of genetic variation. • Various forms of asexual and sexual reproduction can be found across taxonomic kingdoms. • The evolution of sexual reproduction led to increased biodiversity. • Classification is used to group related organisms based upon scientific evidences. 	<ul style="list-style-type: none"> • What are the benefits and limitations of asexual and sexual reproduction and their implications on evolution? • What is the basis of modern classification and how does it demonstrate evolutionary relationships? 	<ul style="list-style-type: none"> • Asexual reproduction involves a single individual producing identical offspring whereas sexual reproduction involves two parents creating genetically varied offspring. • The five types of asexual reproduction (budding, spores, regeneration, binary fission, and vegetative propagation) can quickly produce offspring with limited genetic variation. • The evolution of sexual reproduction resulted in increased genetic variation. • Classification is a fluid process in which related organisms are grouped using physical and molecular evidences 	<ul style="list-style-type: none"> • Evaluate the pros and cons of asexual and sexual reproduction. • Investigate organisms displaying the types of asexual reproduction so as to understand their classification. • Hypothesize how conjugation might explain the transition between asexual and sexual reproduction. • Draw conclusions as to why sexual reproduction results in increased genetic variation. • Summarize why classification schemes have changed over time. • Using scientific evidences, create and/or interpret phylogeny and cladogram models of animals showing species' 	<p>NGSS Standards:</p> <ul style="list-style-type: none"> • HS-LS4-1 Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. • HS-LS4-2 Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment. • HS-LS4-4 Construct an explanation based on evidence for how natural selection leads to adaptation of populations. • HS-LS4-5 Evaluate the evidence supporting claims

		<p>to reveal species' relatedness.</p> <ul style="list-style-type: none"> Animals are classified into phyla based upon body plans and molecular data. 	<p>relatedness due to common ancestry.</p> <ul style="list-style-type: none"> Demonstrate that evolutionary theory operates today as it did in the past and as it will continue to do so in the future. 	<p>that changes in environmental conditions may result in:(1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.</p> <ul style="list-style-type: none"> HS-LS3-2 Make and defend a claim based on evidence that inheritable genetic variations may result from (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.
<ul style="list-style-type: none"> Technological advancements in radiometric dating have allowed us to construct the geological time scale. Major developments in understanding the evolution of life on Earth can be used to separate Earth's geological history into eras and periods. The movement of tectonic plates throughout Earth's 	<ul style="list-style-type: none"> How has the advancement of geology (plate tectonics, radiometric dating, Law of Superposition, geological time scale, etc.) influenced our understanding of the theory of evolution? How have geological processes 	<ul style="list-style-type: none"> Earth's history is divided into 4 geological eras (Precambrian, Paleozoic, Mesozoic, Cenozoic) and their corresponding geological periods. Geological eras and periods are separated by major geological events that are marked by evolutionary changes. 	<ul style="list-style-type: none"> Construct a timeline of Earth's history displaying major events that distinguish geological eras and periods. Use evidence to infer cause and effect relationships between geological events and their impact on life. Investigate half-lives of radioactive 	<p>NGSS Standards:</p> <ul style="list-style-type: none"> HS-LS4-1 Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. HS-LS4-4 Construct an explanation based on evidence for how natural selection leads to adaptation of populations. HS-LS4-5 Evaluate the evidence supporting claims that changes in

<p>history affects the continents and oceans and the evolution of organisms on/in them.</p>	<p>influenced the evolution of life on our planet?</p>	<ul style="list-style-type: none"> ● Plate tectonics has affected the surface of the Earth throughout Earth’s history. ● Dating methods can be used to infer evolutionary change. <ul style="list-style-type: none"> - Radiometric dating methods can be used to identify ages of rock in which fossils from various geological eras and periods are found. - Dendrochronology can be used to identify ages of trees and environmental impacts on the trees. 	<p>materials and how they can be used as a dating method.</p> <ul style="list-style-type: none"> ● Draw conclusions from cross dating samples obtained from two trees. ● Communicate how plate tectonics has impacted life on Earth. ● Demonstrate that evolutionary theory operates today as it did in the past and as it will continue to do so in the future. 	<p>environmental conditions may result in:(1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.</p>
<ul style="list-style-type: none"> ● Mammals evolved from reptiles. ● All members of the mammalian class share several common characteristics due to common ancestry. ● Mammalian subphyla and major orders developed adaptations in response to changing conditions on the Earth. 	<ul style="list-style-type: none"> ● What does fossil evidence reveal about the transitional forms of mammalian evolution? ● What characteristics define the class of mammals? ● What are the most successful adaptations of the main mammalian subphyla and orders? 	<ul style="list-style-type: none"> ● Based upon the fossil record, it is determined that mammal-like reptiles such as pelycosaur and therapsids lead to the evolution of mammals. ● Since all mammalian subphyla and orders are in the same taxonomic phylum and class with a common ancestor, they share common characteristics. 	<ul style="list-style-type: none"> ● Compare/contrast characteristics of mammal-like reptiles such as pelycosaur and therapsids with mammals. ● Identify common characteristics shared by all mammals. ● Investigate characteristics and adaptations of the 3 mammalian subphyla and the 	<p>NGSS Standards:</p> <ul style="list-style-type: none"> ● HS-LS4-1 Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. ● HS-LS4-2 Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable

<ul style="list-style-type: none"> The movement of tectonic plates throughout Earth's history has affected the distribution of mammals around the world. 	<ul style="list-style-type: none"> How has plate tectonics affected mammalian evolution? 	<ul style="list-style-type: none"> The 3 mammalian subphyla and the most prominent mammalian orders developed various anatomical and physiological adaptations as a result of changing geographic location, habitats and niches. Multiple extinct species identified through the fossil record provide evidences for evolution in mammals. Plate tectonics has affected the location and size of continents and oceans throughout Earth's history resulting in a changing distribution of mammals around the world. 	<p>most prominent mammalian orders.</p> <ul style="list-style-type: none"> Summarize fossil, molecular, embryological and anatomical evidences to determine how mammals evolved. Investigate how plate tectonics has affected the distribution of mammalian fossils. Demonstrate that evolutionary theory operates today as it did in the past and as it will continue to do so in the future. 	<p>genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.</p> <ul style="list-style-type: none"> HS-LS4-4 Construct an explanation based on evidence for how natural selection leads to adaptation of populations. HS-LS4-5 Evaluate the evidence supporting claims that changes in environmental conditions may result in:(1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.
<ul style="list-style-type: none"> Adaptations in primates occurred as a result of Earth's changing environmental conditions. 	<ul style="list-style-type: none"> What are the defining characteristics of the primate order? How has the the work of scientists 	<ul style="list-style-type: none"> Primates adapted to changing habitats and niches, passing successful adaptations to their descendants including hominins. 	<ul style="list-style-type: none"> Identify primate adaptations including those found in prosimians, simians, monkeys, apes and hominins. 	<p>NGSS Standards:</p> <ul style="list-style-type: none"> HS-LS4-1 Communicate scientific information that common ancestry and biological evolution are

<ul style="list-style-type: none"> ● Genetic similarities between great apes including hominins indicate their evolutionary relatedness. ● Through the use of improved technologies, scientists have contributed to the better understanding of primate and hominin evolution. ● Bipedalism and other related adaptations occurred due to natural selection acting on genetic variations of primates. ● Hominin migration resulted in interbreeding of hominin species. 	<p>affected our understanding of the evolutionary relationship between humans and other primates?</p> <ul style="list-style-type: none"> ● How did hominin migration affect human evolution? ● What kinds of evidences reveal relatedness of hominins? 	<p>(including prosimians, simians, new world vs old world monkeys, lesser vs great apes, hominins)</p> <ul style="list-style-type: none"> ● Great apes, including hominins, have genetic similarities with one another due to their common ancestry. ● The current understanding of hominin evolution is due to the work of Goodall, Fossey, the Leakey family, Johanson, Berger, Dart, Dubois, Alemseged, and White among others. <ul style="list-style-type: none"> - bipedalism - skeletal - brain - accompanying behaviors ● Fossil evidence and plate tectonics support the migration of hominins from Africa to other parts of the world. ● Fossil, physical and molecular evidences 	<ul style="list-style-type: none"> ● Examine the evolutionary relationships between great apes and hominins and compare these relationships with the genetic similarities between them. ● Differentiate between the discoveries of including when and where they lived as well as their unique characteristics. ● Infer required adaptations for bipedalism and hypothesize other adaptations bipedalism might lead to. ● Compare/contrast the anatomical, physiological and behavioral adaptations acquired by several important hominins from earliest to most recent. ● Using the fossil record, trace the 	<p>supported by multiple lines of empirical evidence.</p> <ul style="list-style-type: none"> ● HS-LS4-2 Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment. ● HS-LS4-4 Construct an explanation based on evidence for how natural selection leads to adaptation of populations. ● HS-LS4-5 Evaluate the evidence supporting claims that changes in environmental conditions may result in:(1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.
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		<p>reveal relatedness of hominins.</p>	<p>migration of hominins to predict where hominin species might have interbred and the impact that might have on modern humans..</p> <ul style="list-style-type: none"> ● Summarize the fossil, physical and molecular evidences that reveal relatedness of hominins. ● Demonstrate that evolutionary theory operates today as it did in the past and as it will continue to do so in the future. 	
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Materials and Resources: Internet resources and "Biology-Principles and Explorations" ISBN 0-03-051433-9 (Holt, Rinehart, Winston) 1998